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CENTRAL INTELLIGENCE AGENCY

WASHINGTON, D.C. 20505

15 June 1976

MEMORANDUM FOR: The Director of Central Intelligence

FROM : William W. Wells
Deputy Director for Operations

SUBJECT : MILITARY THOUGHT (USSR): Materials from
a Conference on Establishing a New
System of Communications

1. The enclosed Intelligence Information Special Report is part of a series now in preparation based on the SECRET USSR Ministry of Defense publication Collection of Articles of the Journal "Military Thought". This article summarizes material from a conference held by the Military Communications Academy to discuss establishing a new communications system to use in automating troop control. Certain reports presented at the conference dealt with automating data processing and establishing a unified communications system for all levels of the armed forces. Other speakers presented proposals for reorganizing communications for control of the rocket troops, and described technical developments such as an automatic error query system, telecode communications equipment to use with computers, and non-protruding antennas. The final speaker recommended that research and development efforts be concentrated on the employment of high-speed, automatic, multichannel and secure communications equipment. This article appeared in Issue No. 2 (63) for 1962.

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2. Because the source of this report is extremely sensitive, this document should be handled on a strict need-to-know basis within recipient agencies. For ease of reference, reports from this publication have been assigned

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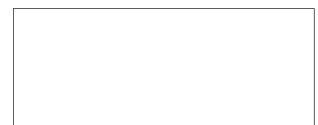
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Intelligence Information Special Report

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COUNTRYUSSR

DATE OF
INFO. Early 1962

DATE 15 June 1976

SUBJECT

MILITARY THOUGHT (USSR): Questions of Establishing a
New System of Communications

SOURCE Documentary
Summary:

The following report is a translation from Russian of an article which appeared in Issue No. 2 (63) for 1962 of the SECRET USSR Ministry of Defense publication Collection of Articles of the Journal "Military Thought". The author of this article is General-Major of Communications Troops I. Kurnosov. This article summarizes material from a conference held by the Military Communications Academy to discuss establishing a new communications system to use in automating troop control. Certain reports presented at the conference dealt with automating data processing and establishing a unified communications system for all levels of the armed forces, which also would involve increasing the number of channels to handle the flow of information. Other speakers presented proposals for reorganizing communications for control of the rocket troops, and described technical developments such as an automatic error query system to improve communications reliability, telecode communications equipment to use with computers, and non-protruding antennas. The final speaker recommended that research and development efforts be concentrated on the employment of high-speed, automatic, multichannel and secure communications equipment.

End of Summary

Comment:

The author, who is deceased, was a lecturer and candidate of military sciences. He also wrote "A Useful Book on Setting up Communications in a Front" in Issue No. 3 (76) for 1965

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Questions of Establishing a New System of Communications
(From material of a military scientific-technical
conference of the Communications Academy)
by
General-Mayor of Communications Troops I. Kurnosov

A scientific-technical conference, devoted to a discussion of the questions of establishing a new system of communications from the standpoint of automating troop control, was held in the Red Banner Military Communications Academy.

Senior officials of a number of the central directorates of the Ministry of Defense and a large number of representatives from the troops, scientific research institutions, higher military educational institutions, and industrial enterprises participated in the work of the conference. In all, 73 reports and 10 scientific papers were presented and discussed at the conference in the plenary sessions and during the work of the eight sections.

Particular interest was aroused by the reports of General-Leytenant Shkodunovich, Candidate of Military Sciences Colonel Zakharov, Colonel Koletskiy, Honored Scientist and Doctor of Technical Sciences Professor Engineer Colonel Kotov, Candidate of Technical Sciences Professor Engineer Lieutenant Colonel Muravyev, and Candidate of Technical Sciences Engineer Colonel Petrovskiy.

General-Leytenant Shkodunovich's report set forth the present-day requirements imposed on troop control and by specific examples showed the incompatibility between the new powerful and long-range means of destruction and the status of means and methods of control. It was the speaker's opinion that the existing system of control is cumbersome, insufficiently mobile, and does not provide the necessary operating efficiency and flexibility. The delay in receiving information on events taking place has become especially intolerable.

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Staffs are processing materials manually, which does not allow them to prepare the required data in compressed periods of time and makes it difficult to arrive at the most correct decisions. As a result, modern means of armed conflict do not always achieve proper results.

The only correct way of resolving this problem is to establish an integrated automated system of troop control based on the use of multi-purpose computers and automatic transceiver equipment.

A unified system of communications. Continuing to develop the propositions stated in General Shkodunovich's report, Colonel Zakharov examined the problems associated with the establishment of a unified system of communications for the Supreme High Command, the front, the army, and the division. He stated that not only are the demands more stringent on communications in automated systems of control, but that there also arises a variety of new tasks associated with providing for the automatic input and output of information, and with linking communications channels with data sensors and electronic computers, and also with further increasing the required number of channels and improving their quality.

The essence of the organizational unity of a communications system consists in the fact that it is not split up into sections of component affiliation. We must set up a net of electrical communications channels capable of passing a large volume of information with the necessary rapidity from the General Headquarters of the Supreme High Command down to the lowest tactical levels.

The General Headquarters communications system should be made up of the communications centers of the General Staff and of the main staffs of the branches of the Armed Forces, the lines and channels connecting the territory of the Soviet Union with the countries of the socialist camp, and the special-purpose communications centers that have been set up by the forces and means of the communications large units and units of the General Headquarters of the Supreme High Command.

The special-purpose communications centers must provide for linking the nation-wide communications net with the

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communications net of the theaters of military operations, and for linking the network of a theater of military operations with the communications system of its fronts (armies). The number of these centers is determined by the nationwide communications net, the development of the communications net in the theaters of military operations, and the operational-strategic deployment of the troops.

The presence of such a well-developed system will eliminate to a considerable degree the threat of having communications disrupted by the effects of modern means of destruction and will also provide for the passage of any flow of information within the required period of time.

In a front, the communications system must be set up along the very same principle with only this difference, that the capacity of axial and lateral communications lines will be lower and that the special-purpose communications centers will be replaced by zonal, supporting, and auxiliary centers. For each first-echelon army it is necessary to establish a communications link with the use of cable, radio-relay, and radio means. In addition, a main artery line with greater capacity than the communications links must be established.

In Colonel Zakharov's opinion, the presence of such a net will make it possible to provide communications with more than just the first-echelon armies. Any formation, large unit, and unit which is in need of establishing communications with the front communications centers can do this easily by setting up a connecting line to the nearest zonal communications center of the system. And what is more, in this case there will be no need to preserve the well-known principle that the higher level is responsible for communications to the lower level.

It should be noted that the suggestion to provide communications only through zonal, supporting, and auxiliary centers, abolishing the principle that the higher level is responsible for communications to the lower level, was not supported by the conference participants. And this, in our opinion, is correct, for the more complex the communications system is, and the higher the requirements imposed upon it, the more strictly should we observe the principles on which it is set up and the responsibility for its operation. We also consider

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the classification of the communications centers to be incorrect. There is no practical necessity to introduce the new terms "zonal" and "supporting" centers. It is better to leave alone the already established term, "auxiliary communications center". As concerns the system of communications, in principle there are no objections to it. However, we believe that for communications with the troops of the first echelons and with the rocket troops, priority should be given to direct communications, with bypass communications going through the auxiliary communications centers.

In Colonel Zakharov's opinion, the primary means of communications at the General Headquarters-front and front-army levels should be wire and radio-relay. However, in case the wire and radio-relay communications channels are disrupted, no more than 10 percent of all the information can be transmitted by radio, considering its limited number of channels and low quality. In doing so, the most important information must be included in this 10 percent. While the majority of the conference participants did not object to this assessment of the role of the different means of communications, they proposed that all measures be taken to increase the multichannel capacity and to improve the quality of radio communications so as to enhance their role in the overall system of communications. This is needed all the more because the stability of the operation of radio-relay, and especially of wire, means of communications under conditions of missile/nuclear war gives rise to serious apprehensions.

Substantiating the necessity of considerably increasing the number of communications channels on the axial and lateral lines, the speaker brought up certain data characterizing the flow of information. According to the calculations of a military science group of the Academy i/n M. V. Frunze, the flow of information at the front-army level will reach 120,000 words (groups) per day. In order to ensure the timely passage of this information it will be necessary to have no less than 300 to 320 standard telephone channels from the front command post and 80 to 100 of the same kind of channels from the rear control post.

In sum, to provide communications from all control posts of a front we need approximately 800 standard telephone channels. To establish such a system in a front offensive zone, the speaker

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asserted, would require deploying up to 55 auxiliary communications centers, approximately 350 radio-relay sets, up to 45 tropospheric communications sets, up to 30 powerful shortwave transmitters, and up to 4,000 kilometers of long-range communications cable; and in order to establish and service such a system, it would be necessary to have no less than 30 communications battalions with a considerable number of personnel.

The communications system of an army is one of the levels of the unified front system and represents the sum total of the communications centers and lines deployed in the offensive zone. It was estimated that from the control posts of the troops of an army it is necessary to receive information from 110 to 150 sources, which requires 200 to 210 communications channels. To provide this number of communications channels an army has to have 120 to 150 radio-relay sets and 500 to 550 kilometers of cable. Six to seven communications battalions can service these means.

In each division a system of communications, unified for all the branch arms, is also established. The total number of information sources ranges from 62 to 88, which requires a considerable increase in the number of channels compared to the existing number.

The conference participants expressed doubt as to the necessity of such a large number of information sources and proposed a serious revision of the flow of information. Only in this way can we decrease the number of communications channels, and consequently increase the mobility and stability of the entire communications system. It was also suggested that it would be undesirable to have several electronic computers at such a level as the division level, and that it would be more advantageous to solve all problems on a single multi-purpose computer.

Speaking on the subject of the communications of the rocket troops and artillery, Lieutenant Colonel Grishin said that in order to provide for the control of the rocket troops, the best means at the disposal of the front chief of communications troops should be allocated. For this purpose, all of the communications forces and means must be concentrated in the hands of the front

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chief of communications troops; to allocate some portion of them to establish an autonomous communications system for the rocket troops is not advisable, since in this case it would lower the level of responsibility for the state of the most important communications.

One cannot exclude the possibility of establishing and deploying small communications centers in order to receive direct channels right in the staff of the rocket troops and artillery. This would take place only in case the staff of the rocket troops and artillery were found to be territorially distant from the front staff.

DB | In this connection, the opinion was expressed that the control batteries and battalions of the staffs of the rocket troops and artillery should be reorganized into communications companies and platoons and placed in subordination to the chief of communications troops of the front (army). The conference approved the proposal to introduce the position of a front (army) deputy chief of communications troops for rocket troops and artillery.

The technical principles of setting up a communications system. In his report, Colonel Koletskiy set forth preliminary considerations on the technical principles of setting up a unified system of ground communications for the Armed Forces. He emphasized that extremely high requirements are imposed under present-day conditions on communications means and systems with respect to both the number and the quality of the channels. These requirements should include, first of all: to provide for the automatic and semiautomatic transmission of various types of telecode information at a high rate of speed and with the required reliability; to transmit all types of information using automatic secure communications equipment with the necessary degree of stability; to automatically extract information from the different data sensors and transmit it via communications channels; to transmit information directly to the working areas of the operations personnel, where they will have the capability of documenting and displaying the information.

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The solution to these problems can only be found by extensively using multichannel means of communications. In doing so, one of the most important tasks in organizing communications

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is to develop a schematic diagram which will most fully exploit the advantages of multichannel communications lines.

A valuable technical accomplishment, as the report revealed, was the fact that these high requirements with respect to communications can for the most part be met by using the communications equipment that has been provided for in the seven-year procurement plan.

The speaker reported that many of the elements of the automated troop control system have been developed by the institute in cooperation with other scientific and educational institutions. They have produced working models, making it possible to test them on the communications lines and channels. At the same time, he pointed out that with regard to many problems, particularly the problems associated with automatic channel switching equipment, without which automated systems cannot operate, there is a lack of clarity even in the theory of their development.

Next, Colonel Koletskiy pointed out that in his opinion it has become necessary to establish norms for some of the technical characteristics of the communications system, such as for the speed of information transmission, reliability of transmission, the width of the frequency bands of the communications channels, the phase and amplitude characteristics, the number of channels in the trunk groups (trunk lines), the requirement for secondary multiplexing of the trunk groups, the operating reliability, etc. As regards automatic secure transmission, it must be implemented by means of devices which organically form a part of the channeling or on-line equipment. We must strive for the group use of secure communications equipment in order to utilize the equipment more efficiently and reduce the amount of it at the control posts.

In order to simplify the technical devices in automated systems, insofar as possible information should be transmitted in the form of formalized commands and reports using numbers only.

With some relatively minor additions and modernization, the existing communications means and those that are being developed basically will be able to provide troop control during the next few years. To do this, it is necessary to develop linking

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devices, equipment for high-speed remote control, switching equipment, and equipment to increase reliability. Subsequently, we must produce new means of communications that will satisfy all modern requirements.

The lecture of Distinguished Scientist, Professor and Doctor of Technical Sciences Kotov on the subject, "An Automatic Error Query System with a High Correction Capability", aroused great interest. The interest in this topic was due to the fact that in automated troop control, communications reliability must be extremely high, and this has not been possible even in the best underground cable channels. Furthermore, this task has not been accomplished with respect to radio-relay and radio communications channels. The group headed by the speaker developed and presented a working model of a device for automatic error query (AZO), with the aid of which one can attain a transmitting reliability of 10^{-5} , that is, of not more than one distorted pulse out of every 100,000 that are transmitted.

The circuit, upon examination, proved to be simple enough and the device itself was of limited weight and size. Under laboratory conditions an even more improved circuit has been tested, one that makes it possible to achieve a transmitting reliability that is three to four times higher.

The subsequent speakers, Engineer Captain Parshin and Engineer Lieutenant Colonel Sidorov, described in detail the principal elements of an automatic error query circuit that has a high correction capability, and also described the results of testing it on communications channels.

The development of an automated troop control system has required the development of a new type of terminal equipment -- telecode communications equipment. In the opinion of Engineer Colonel Petrovskiy, it must provide for the exchange of telecode information between data sensors, automatic information processing devices (electronic computers), and remote display devices. The use of telecode communications for the exchange of information by means of electronic computers requires high transmitting reliability, which can be achieved by using those codes which detect errors and automatically query the distorted lines. Work in this field is being conducted at the Central

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Scientific Research Institute of Communications Engineers together with the telegraphy department of the Military Communications Academy.

Antenna systems. The report made on this topic by Engineer Lieutenant Colonel Muravyev set forth the principles of constructing highly efficient non-protruding antennas which have electrically-controlled radiation patterns.

It is well known that under conditions of missile/nuclear war, protruding antennas will be speedily destroyed, and that even with the availability of spare sets of antennas this will lead to loss of communications or loss of radar surveillance. But non-protruding antennas, including buried ones, are not used widely yet owing to their low efficiency. Naturally, the work aimed at solving this problem is extremely urgent.

The greatest directivity of emission can be achieved by means of antennas laid out in the shape of a disk on whose surface a sufficiently large number of radiating elements have been positioned.

In the opinion of Engineer Captain Zakharov, for the non-protruding and buried ultra-shortwave antennas one can use non-directional vertically and horizontally polarized radiating elements. He suggested using as an antenna for this a slotted wide-band antenna in the form of a system of four U-shaped radiating elements. In order to increase the mechanical strength of the channel cavities, the slits are filled with bitumen. Tests of an experimental production run of such antennas revealed it is possible to mass produce them.

Regrettably, the actual realization of the suggested ideas is lagging considerably and up to now in the troops we have been using primitive antennas with low efficiency and intolerably low mechanical strength.

A variety of other questions were also examined at the conference: a communications system for the air defense forces of the country, a ground communications system for the Navy, the organization of communications in the US Army and in the aggressive NATO bloc, communications centers, reconnaissance and jamming, the receiving and transmission of discrete signals,

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communications equipment, and the receiving of superhigh frequencies.

Marshal of Communications Troops Leonov, Chief of Communications Troops of the Ministry of Defense, presented the concluding report. He emphasized that the joint work of scientific groups from many military educational institutions and scientific research institutes on the solution of wide-ranging problems constitutes an extremely valuable and useful collaboration. Attesting to this was the successful completion of the scientific research work "Control". The scientific groups of the Central Scientific Research Institute of Communications Engineers and of the Communications Academy achieved good results in resolving a series of questions associated with the development of new equipment for the integrated automation of troop control.

At the same time, Marshal Leonov mentioned a number of deficiencies in this military science and scientific research work.

In regard to the work "Control", he pointed out its uncritical approach to the evaluation of initial data for determining the sources and flow of information. The calculations of the scientific group from the Academy i/n M. V. Frunze were accepted as law by all the executors. As a result, the requirements for channels have increased to eight to ten times more than those available. This situation has led to the establishment of an exceedingly unwieldy communications system having limited stability, which has entailed an increase in the amount of communications means and in the number of personnel. And what is more, the required number of different communications means was determined without giving proper consideration to economic capabilities, jeopardizing the scheduled plans for the completion of even an experimental complex of an automated system of troop control.

The scientific research work "Control" proposes a completely finished system of integrated automation which will solve all of the problems associated with troop control. However, the work does not devote enough attention to the problems of the transition period, that is, to the period during which existing communications means are to be improved and brought up to a state

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of full automation. It would be incorrect to expect that there will occur some sort of abrupt transition from the existing system; in actuality, there will be the unavoidable process of gradually replacing existing communications means with the new ones as these are received from industry.

In discussing the unified system of communications, Marshal of Communications Troops Leonov pointed out that it is not fully compatible with present-day views on the conduct of the battle and operation. To a certain degree, the proposed system has a linear nature and does not take fully into account the possibility of vast destruction of communications installations, the presence of extensive areas of radioactive contamination, and that the war will be characterized by scattered centers of fighting.

Touching upon the role of radio communications in the integrated system of automated troop control, the speaker pointed out the need to carry out scientific work on improving the quality of radio means.

In speaking on the problems in the field of the development of new equipment for troop control, Marshal Leonov emphasized the importance of the following: the employment of multichannel radio-relay sets with automatic retransmission; the use of multichannel equipment on cable and permanent overhead lines; the introduction into the troops of automatic secure communications equipment for telegraph and telephone conversations; the use of radio sets which indicate when they are being called and which automatically adjust frequencies; the employment of superhigh-speed operation; the use of special-coding devices; the mechanization of the work of laying underground cable lines, etc.

It is precisely in this field that our scientists must apply their efforts so as to gradually provide the communications system for the fully automated control of troops and weapons.

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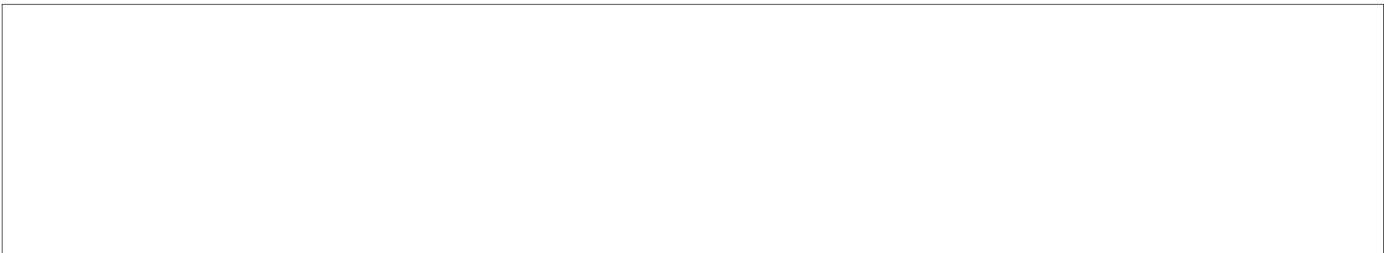
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Together with this, we must seriously train personnel for receiving and servicing the new equipment which the troops will gradually be receiving in ever-increasing numbers. Marshal Leonov cautioned against the excessive enthusiasm of those who do not take actual capabilities into consideration and who are ready to make the transition to an automated system of control even tomorrow.

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